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# Effect of Replacement of Soybean Meal With Fish Meal on Growth Performance And Carcass Characteristics of Japanese Quail

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Three-hundred-day old quail chicks were used in a completely randomized design to evaluate the effect of replacement of soybean meal with fish meal on growth performance and carcass characteristics of Japanese quail. The chicks were randomly distributed into four groups and divided into three replicates (n = 25/replicate). Four iso-nitrogenous (CP 20%) and iso-caloric (ME 3000 kcal/kg) diets were formulated replacing soybean meal with fish meal. Diet A (Control), B, C and D included 0, 15, 30, and 45% fish meal respectively. Quail chicks were fed for 42 days of trial. Data on feed intake, weight gain and feed to gain ratio were recorded. The data was analysed using analysis of variance technique by completely randomized design using Minitab and Tukey's test was used to compare the means. Feed intake was found non-significantly different among all treatments, however, replacing soybean with fish meal up to 30% with soybean meal numerically increased the feed intake. Similarly, weight gain remained unaltered among all treatments, however, replacing soybean meal with fish meal 30% resulted in the highest weight gain in Japanese quail. Feed conversion ratio was 3.48, 3.52, 3.35 and 3.34 in quail chicks fed 0, 15, 30, and 45% fish meal respectively. Feed conversion ratio did not show significant results by replacing soybean meal with fish meal. While numerically, slightly better FCR resulted by 45% substitution of dietary soybean meal with fish meal diet. The percentage of carcass, chest, leg, heart, liver and gizzard remained unchanged across all diets.
**Keywords:** Carcass yield, dressing percentage, growth performance, slaughter parameters, weight gain.

## INTRODUCTION

Japanese quail are being used for commercial meat and egg production. Adult body weight of Japanese quail is 165 g on an average, which is achievable at the age of 4-5 weeks and they are ready for being marketed at this weight and age (Ashok and Prabakaran, 2012). Quail meat is well known due to their protein quality of high biological value and less caloric content which make it a choice food item for the person prone to hypertension (Odunsi *et al.*, 2013). Quails require good quality protein with balance amino acids, their extra protein ingestion also results in high nitrogen excretion in dropping and decrease feed efficacy (Soares *et al.*, 2003).

Fish meal (FM) is an important protein source due to its quality protein, amino acids (Karimi, 2006), minerals and vitamins (Mikulec *et al.*, 2004). Moreover, adequate amount of all essential amino acid is present in FM meal, especially methionine and lysine (Khatoon *et al.*, 2006). Soybean contains several anti-nutritional factors and natural toxins which are subsequently transfer in soybean meal (SBM), the most challenging is trypsin inhibitor which effects the protein digestion and cause pancreatic hypertrophy in birds (McNaughton, 1981). In developing countries, the price hike of traditional feed ingredients is major constrain of the poultry industry especially SBM (Attia *et al.*, 2023). In Pakistan, the production of SBM is limited and most of the SBM used in poultry feeds is imported from other countries making it an expensive feed ingredient (Ullah *et al.*, 2017). Concurrently, Pakistan produces 40000- 45000 tons of fish yearly from different species of fish such as *Trichogaster chuna*, *Cirrhinus mrigala*, *Barilius barila* and *Johnius belangerii* (Nadeem, 2003). As the prices of conventional ingredients of poultry feed are elevating day by day, the nutritionists are in search of alternative protein sources such as FM for nutritionally balanced and cost effective poultry diet (Alagawany *et al.*, 2015; Laudadio *et al.*, 2014).

Poor digestibility of SBM is caused by anti-nutritional factors like trypsin inhibitor, that interact with endogenous protease and cause pancreatic hypertrophy which leads to growth retardation (Liener, 1994). However, soybean faces challenges such as intermittent supply, limited availability, elevated costs, trade disputes and political factors. As

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recently, its price has also increased, so there is a need for a nutritious and cost-effective alternative (Laudadio *et al.*, 2014) having the least anti-nutritional factors. The FM is a good protein source that can be used for dietary replacement of SBM in birds. Main reason of using FM in poultry feed is its appropriate price when compared with SBM because it's high biological profile and limited anti-nutritional factors which may affect performance of birds. Animal protein sources contain more available phosphorus and essential amino acids (Sell and Jeffrey, 1996; Wang and Parsons, 1998).

Fish meal is a good source of protein which is used as substitute of other animal and plant protein sources (Ponce and Gernat, 2002). Fish meal enhanced feed intake and feed efficiency in broilers and layers (Solangi *et al.*, 2002). The FM may replace SBM crude protein up to 50% without negative effect on bird's performance (Maigualema and Gernat, 2003). Salih (2009) reported that 3.5% addition of FM in poultry diet significantly improved carcass yield and he further reported that up to 5% inclusion of FM cause no fishy smell. Totally extrusion of fish meal from broiler diet depressed performance and growth parameters (Yisa *et al.*, 2013). Eyng *et al.* (2013) reported that fish meal used as substitute source of protein in poultry diet up to 8%. Feed intake and weight gain increases with inclusion of FM in starter and grower diets (Karimi, 2006). There is limited data on gradual replacement of SBM with FM. Thus, present study is planned to assess the gradual replacement of SBM with FM on growth performance and carcass composition of Japanese quail.

## MATERIALS AND METHODS

***Birds and Housing*:** The research trial was conducted at Raja Muhammad Akram Animal Nutrition Research Center, University of Agriculture, Faisalabad. All procedures followed in the conduct of this experiment were approved by Advanced Studies and Research Board, University of Agriculture, Faisalabad, Pakistan. Three hundred day old quail chicks were incurred from a local hatchery and housed in twelve pens with dimension of 4×3 ft². Initial body weight was recorded. Poultry house was disinfected and fumigated. All the birds were kept under homogenous environmental conditions (temperature, ventilation and humidity) throughout the research trial.

***Experimental design and diets*:** Three-hundred-day old quail chicks were randomly allotted into 4 experimental groups comprising of 3 replicates containing 25 quails in each replicate. Each treatment was randomly assigned three separate pens as replicates. Four iso-caloric (ME 3000 kcal/kg) and iso-nitrogenous (CP 20%) diets were formulated containing SBM replacement with FM at the level of 0, 15, 30, and 45% (Table 1 and 2). Mashed form of feed and water was provided to the broilers ad libitum from day 1 to 42.

**Table 1. Ingredients composition of experimental diets.**

| Ingredients | Experimental diets | | | |
|---|---|---|---|---|
| | A | B | C | D |
| Maize grain | 43.98 | 45.70 | 49.14 | 51.30 |
| Rice tips | 10.00 | 10.00 | 10.00 | 10.00 |
| Rice polishing | 6.00 | 6.00 | 6.00 | 6.00 |
| Corn gluten 60% | 1.98 | 0.93 | 0.50 | 0.20 |
| Soybean meal | 24.96 | 21.21 | 17.47 | 13.72 |
| Fish meal | 0.00 | 3.75 | 7.49 | 11.23 |
| Canola meal | 3.97 | 4.42 | 3.39 | 2.74 |
| Molasses | 2.00 | 2.00 | 2.00 | 2.00 |
| Vegetable oil | 2.97 | 2.65 | 1.42 | 1.00 |
| Limestone | 0.87 | 0.67 | 0.52 | 0.30 |
| DCP | 1.64 | 1.10 | 0.52 | 0.00 |
| L- Lysine Sulphate | 0.91 | 0.88 | 0.87 | 0.86 |
| DL- Methionine | 0.22 | 0.20 | 0.19 | 0.17 |
| L-Threonine | 0.40 | 0.39 | 0.39 | 0.38 |
| *Vitalink® | 0.05 | 0.05 | 0.05 | 0.05 |
| **Nutrimin® | 0.05 | 0.05 | 0.05 | 0.05 |

*Vitalink® is a vitamins premix; each Kg of it supplied the following: Vitamin A 20000 KIU; Vitamin D3 5400 KIU; Vitamin E 48000 mg; Vitamin K3 4000mg; Vitamin B1 4000 mg; Vitamin B2 9000 mg; Vitamin B6 7600 mg; Vitamin B12 20 mg; Niacin 60000 mg; Pantothenic acid 20000 mg; Folic acid 1600 mg; Biotin 200 mg. **Nutrimin® is a minerals premix; each Kg of it supplied the following: Iron 10000 mg; Zinc 120000 mg; Manganese 140000 mg; Copper 12000 mg; Iodine 1800 mg; Cobalt 400 mg; and Selenium 360 mg

**Table 2. Nutrients composition of experimental diets.**

| Nutrients (%) | Experimental diets | | | |
|---|---|---|---|---|
| | A | B | C | D |
| Crude protein | 20.00 | 20.00 | 20.00 | 20.00 |
| *ME (Kcal/Kg) | 3000.00 | 3000.00 | 3000.00 | 3000.00 |
| Crude fiber | 3.14 | 3.03 | 2.79 | 2.58 |
| Ether extract | 6.00 | 6.00 | 5.13 | 5.04 |
| Calcium | 0.85 | 0.85 | 0.85 | 0.85 |
| Available phosphorous | 0.50 | 0.50 | 0.50 | 0.50 |
| Methionine | 0.50 | 0.50 | 0.50 | 0.50 |
| Lysine | 1.30 | 1.30 | 1.30 | 1.30 |
| Threonine | 1.02 | 1.02 | 1.02 | 1.02 |

*ME: Metabolizable energy

***Experimental measures, sampling and analysis*:** Weekly feed intake was recorded and averaged for whole period. Feed intake was determined by feed offered minus feed refusal. Weekly body weight was recorded and average weight per bird according to their corresponding replicates was calculated at the completion of each week. Feed conversion ratio was calculated by feed intake divided by weight gain of birds. Carcass characteristics were determined at termination day of trial. Four birds per pen were randomly selected, weighed individually and slaughtered by halal method. After processing feathers detached, evisceration was done in order

to obtain weight of carcass including internal organs (gizzard, liver and heart), breast weight and thigh weight of the birds for determining the dressing and organs percentage followed by Guo *et al.* (2020) and Liaqat *et al.* (2025).

Dressing percentage was determined by using dressed weight (g) divided by live weight (g) and multiplied by 100.Chest weight percentage was calculated by using chest weight (g) divided by live weight (g) and multiplied by 100. Legs weight percentage was calculated by using legs weight (g) divided by live weight (g) and multiplied by 100. Liver weight percentage was determined by using liver weight (g) divided by live weight (g) and multiplied by 100. Heart weight percentage was calculated by using heart weight (g) divided by live weight (g) and multiplied by 100.Gizzard weight percentage was calculated by using gizzard weight (g) divided by live weight (g) and multiplied by 100.

Dry matter (DM) of diet was determined by drying it in an oven at 105°C till constant weight was attained (AOAC, 2000). Feed samples were grinded to produce finely ground powder to estimate N percentage by Kjeldahl method and crude protein (CP) was calculated by multiplying N (%) with factor 6.25 (AOAC, 2000). Crude fat determination was carried out by petroleum ether extraction, using the Soxhlet apparatus. Crude fiber and ash were determined according to the procedure described by AOAC (2000).

***Statistical analysis*:** Data collected on feed intake, weight gain, FCR and carcass characteristics were analyzed by analysis of variance technique in a completely randomized design using Minitab17 (version 19.2). Differences among means were compared by Tukey's test (Steel *et al.*, 1997). The statistical significance between group means was estimated at $p \leq 0.05$.

## RESULTS

***Growth performance*:** Replacing SBM with FM showed non-significant (P>0.05) impact on body weight gain. However, replacing SBM with 30% FM showed numerically higher weight gain comparatively other treatments. Feed intake of birds also showed statistically non-significant (P>0.05) results. But experimental birds given 15 and 30 % replacement of SBM with FM showed numerically higher feed consumption than birds given 0 and 45% replacement level of SBM with FM. Similarly, birds showed statistically non-significant (p>0.05) results with numerically better FCR by replacing 15% SBM with FM.

The feed intake of the birds fed diets containing various substitution levels of fish meal for soybean meal is given in Table 3. Feed intake was non-significant (P>0.05) by the various treatment diets however it was slightly high in treatment C (498.1g) which contained a 30% replacement level of SBM with FM and low in treatment group D (474.0 g) which contained 45% replacement level of SBM with FM.

The mean values for body weight gain (BWG) of the Japanese quails fed diets contained different substitution levels of FM for SBM is given in Table 4. Body weight gain was non-significantly (P>0.05) affected by the different dietary treatments. But experimental birds fed on diet C (30% replacement of SBM with FM) showed slightly high value for body weight gain (144.91 g) and birds fed on diet B (15% replacement level of soybean meal with fish meal) showed low value regarding body weight gain (135.78 g).

Replacement of SBM with graded levels of FM had non-significant (p>0.05) effect on FCR of quail chicks. Mean values for feed conversion ratio of the Japanese quails fed diets contained different substitution levels of fish meal for SBM is given in Table 3. Average FCR of quail chick fed 0, 15, 30, and 45% of fish meal was 3.475, 3.520, 3.352 and 3.335 respectively. Numerically better FCR (3.33) was calculated in quail chicks fed 45% replacement of SBM with FM while, poorer FCR (3.52) was noted in quails fed 15% replacement of SBM with FM.

**Table 3. Effect of experimental diets on growth performance of Japanese quails.**

| Parameters | Treatments | | | | SEM | P-value |
|---|---|---|---|---|---|---|
| | A (Control) | B | C | D | | |
| Feed intake (g) | 477.80 | 488.00 | 498.10 | 474.00 | 14.800 | 0.667 |
| Weight gain (g) | 136.37 | 135.78 | 144.91 | 137.90 | 3.360 | 0.271 |
| FCR | 3.50 | 3.59 | 3.44 | 3.44 | 0.132 | 0.707 |

**Table 4. Effect of experimental diets on relative dressing and giblet organs percentage per quail.**

| Parameters | Treatments | | | | SEM | P-value |
|---|---|---|---|---|---|---|
| | A (Control) | B | C | D | | |
| Dressing weight (%) | 60.07 | 58.81 | 60.49 | 61.07 | 1.06 | 0.50 |
| Heart weight (%) | 1.01 | 1.06 | 1.05 | 1.02 | 0.04 | 0.76 |
| Chest weight (%) | 38.10 | 38.30 | 39.57 | 40.37 | 0.73 | 0.25 |
| Legs weight (%) | 21.04 | 20.27 | 20.90 | 20.71 | 0.45 | 0.64 |
| Gizzard weight (%) | 2.22 | 2.10 | 2.38 | 2.40 | 0.14 | 0.34 |
| Liver weight (%) | 2.19 | 2.42 | 2.13 | 2.39 | 0.15 | 0.42 |

***Slaughter parameters*:** Data on dressing weight %, heart weight %, chest weight %, legs weight %, spleen weight %, gizzard weight % and liver weight %, of Japanese quails are showed in Table 4. The average dressing percentage per quail fed diets A, B, C, and D was 60.07, 58.81, 60.49, and 61.07 percent, respectively. Data of dressing percentage showed non-significant (P>0.05) differences between the treatments. However, numerically slightly greater dressing percentage was noted in quails fed 45% replacement of SBM with FM and minimum dressing percentage was noted in quails fed 15% replacement of SBM with FM.

The mean values for heart weight percentage of the birds given diets contained various substitution levels of FM for SBM. Percentage of heart weight of each quail bird fed diets A, B, C and D was 1.007, 1.059, 1.054 and 1.054 percent on an average basis, respectively. The statistical exploration of the data of heart weight percentage showed no significant difference (P>0.05) amongst the groups fed experimental diets.

The mean values for chest weight percentage of the Japanese quails which were fed on diets contained various substitution levels of FM for SBM. Average weight percentage of chick fed diets A, B, C and D was 38.10, 38.30, 39.57 and 40.37 percent, respectively. The statistical analysis of chest weight percentage data displayed non-significant differences (P>0.05) among groups fed experimental diets.

Average legs weight percentage per quail chick fed diets A, B, C and D was 21.04, 20.27, 20.90 and 20.71 percent, correspondingly. The statistical analysis of legs weight percentage data showed no significant variations (P>0.05) among groups fed experimental diets. The average leg weight percentage of quails fed diets with varying levels of FM as a replacement for SBM was recorded.

The statistical analysis of gizzard weight percentage data showed non-significantly differ (P>0.05) values among groups fed experimental diets. Gizzard weight percentage of the Japanese quails fed diets contained various substitution levels of fish meal for SBM. Average gizzard weight percentage per quail chick fed diets A, B, C and D was 2.22, 2.10, 2.38 and 2.40% accordingly.

Average liver weight percentage per quail fed diets A, B, C and D was 2.19, 2.42, 2.13 and 2.39 % respectively. The mean values for liver weight percentage of the birds which were fed diets contained various substitution levels of FM for SBM. The statistical exploration of liver weight percentage data showed non-significantly different (P>0.05) values amongst groups fed different experimental diets.

## DISCUSSION

***Feed intake*:** In the current trial feed intake of Japanese quail was found non-significantly different among all treatments. Our findings align with the results of Jassim (2010) who reported that different levels of FM had no influence on the feed consumption of birds. However, replacement of plant protein source with FM resulted in decreased feed intake, which was attributed to various factors including dietary amino acid imbalance and high dietary fiber Agbede and Aletor (2003). Similarly, Acar *et al.* (2024) reported that partial replacement of SBM with alternative local protein sources, such as agri-industry by-products and black soldier fly larvae meal, had no effects on broiler feed intake, suggesting that alternative protein sources can sustain normal consumption patterns. Likewise, Attia *et al.* (2023) observed that SBM replacement with black soldier fly larvae meal at 3% during the starter period and 5% during the grower-finisher periods did not increase the feed intake of broilers. Similarly, Khan *et al.* (2023) reported that SBM replacement with maggot meal in the broiler diet at 0, 70, 80 and 100 percent had no impact on feed intake of all groups. Marchal *et al.* (2024) observed that broilers fed totally SBM replaced diets with alternative plant based ingredients and combination of feed additives did not show any effect on feed consumption. Furthermore, Salih (2009) also reported that imported protein concentrates replacement with roasted FM at various substitute levels had no differences on birds' feed intake. Similar findings were reported by Avila and Balloun (1974), Babidis *et al.* (2002), Odunsi *et al.* (2007), Seifdavati *et al.* (2008), Mutucumarana *et al.* (2010) and Yisa *et al.* (2013).

The results of the present study are in contrast of study by Ramírez-Ramírez *et al.* (2016), who reported that replacing SBM with a fish silage mixture at different inclusion levels significantly affected feed intake in birds. Similarly, Ponce and Gernat (2002) concluded that replacing SBM protein with FM protein at different levels improved feed intake. Increase in feed intake and growth rate with fish meal may be due to the replacement of plant protein source with high quality animal protein source, as generally the amino acid contents and protein quality of animal protein source is considered to be superior than that of plant sources. Karimi (2006) revealed that higher fish meal dietary inclusion level had higher feed intake of birds. Al-Marzooqi *et al.* (2010) reported that soybean meal partially replaced by fish meal had significant effect on birds' feed consumption. Similar findings were reported by Khempaka *et al.* (2006), Oduguwa *et al.* (2004), Hossain *et al.* (2012), Maigualema and Gernat (2003).

***Body weight gain*:** In this trial, the BWG of Japanese quail was found non-significantly different among all treatments. Our findings are in agreement with the outcomes of Karimi (2006) who revealed that different dietary inclusion of fish meal had not pointedly influence the birds' BWG from 0-20 days. Ramírez-Ramírez *et al.* (2016) evaluated that weekly weight gain of birds was not significantly improved by the mixture of fish silage and SBM at different inclusion levels in the diet of birds. Similarly, Acar *et al.* (2024) reported that the partial replacement of soybean with alternative local agri-industry by-products and black soldier fly larvae meal diets

had no effect on the BWG of broilers. Salih (2009) also observed no variations in the weight gain of birds fed roasted FM as a replacement of imported protein concentrates at various substitute levels. Avila and Balloun (1974) used 0, 2, 4, 6 and 8% FM as substitute of SBM and reported that substitution of SBM with FM up to 8% cause statistically no impact on BWG of birds. Likewise, Khan *et al.* (2023) reported that SBM replacement with maggot meal in the broiler diet at 0, 70, 80 and 100 percent had no difference on BWG of all groups. Similar findings were reported by Attia *et al.* (2023), Oduguwa *et al.* (2004), Okoye *et al.* (2005), Mutucumarana *et al.* (2010) and Adeyemi *et al.* (2013).

On the other hand, our results are not in line by the results of Ponce and Gernat (2002) reported that BWG of birds had improved by the substitution of soybean meal protein by the fish meal protein at different levels. Hossain *et al.* (2012) used various protein sources (SBM, canola meal and FM) and assessed their impacts on bird's performance from 1-21 days. They found that BWG had significantly increased by addition of FM. Al-Marzooqi *et al.* (2010) concluded that partially substitution of SBM with fish silage had substantial effect on weight gain of birds. Waldroup *et al.* (1965) evaluated the impacts of replacing SBM protein with FM protein on bird performance and declared that diets containing 25 and 75% SBM and FM protein had significant effects on weight gain. Similar findings were reported by Rojas *et al.* (1969), Maigualema and Gernat (2003), Khempaka *et al.* (2006), Bolu and Adakeja (2008), Hassanabadi *et al.* (2008), Jassim (2010), Abro *et al.* (2012), Dahouda *et al.* (2013) and Ullah *et al.* (2018).

***Feed conversion ratio*:** The results of this study regarding FCR are in agreement with the findings of Ramírez-Ramírez *et al.* (2016) who reported that mixture of different levels of fish silage and SBM did not significantly improve the feed to gain gain ratio in birds. Salih (2009) observed that imported protein concentrates replacement by the roasted fish meal at various substitute levels had no differences in FCR of treatment birds. Karimi (2006) established that different dietary inclusion level of fish meal had no effect on the feed to gain ratio of birds. Mikulec *et al.* (2004) concluded that FCR of birds had not significantly improved by the various protein source diets (Fish, sunflower and soybean meals). Acar *et al.* (2024) reported that the partial replacement of soybean with alternative local agri-industry by-products and black soldier fly larvae meal diets had no effect on FCR of broilers. Marchal *et al.* (2024) observed that FCR was not different among the broilers fed totally soybean meal replaced diets with alternative plant based ingredients and combination of feed additives. Avila and Balloun (1974) studied the effects of fish meal as replacement of soybean meal. They found that no effect on FCR of birds. Khan *et al.* (2023) reported that soybean meal replacement with maggot meal in the broiler diets at 0, 70, 80 and 100 percent had no differences in FCR of all groups. Similar findings were reported by Wu *et al.* (1984), Okoye *et al.* (2005), Hossain *et al.* (2012), Hasni *et al.* (2014), Hossain *et al.* (2017) and Attia *et al.* (2023).

The results of the present study are not in agreement with the findings of Ponce and Gernat (2002) who reported that substitution of soybean meal protein with fish meal protein at various substitute level had significant affect the FCR of birds. Al-Marzooqi *et al.* (2010) noted that at different levels of replacement of soybean meal with fish silage had improved the feed conversion ratio of birds. Jassim (2010) found that addition of different levels of animal protein source i.e. fish meal in the feed had improved the feed to gain ratio of birds. Maigualema and Gernat (2003) distinguished that plant protein source (SBM) replacement with fish meal protein at various level had improved on the FCR of birds. Similar findings were reported by Waldroup *et al.* (1965), Rojas *et al.* (1969), Oduguwa *et al.* (2004), Hassanabadi *et al.* (2008), Abro *et al.* (2012), Bovera *et al.* (2016) and Ullah *et al.* (2018).

***Slaughter parameters*:** In present study carcass characteristics of Japanese quail was found non-significantly different among all treatments. The results are in line with the results of Ramírez-Ramírez *et al.* (2016) who revealed that mixture of different levels of fish silage and soybean meal did not significantly improve the carcass yield of birds, but significantly lowest carcass fat was noted in groups which fed 0% mixture of fish silage and soybean meal. Acar *et al.* (2024) reported that the partial replacement of soybean with alternative local agri-industry by-products and black soldier fly larvae meal diets had no effect on the slaughter weight of broilers. Eyng *et al.* (2013) reported that carcass, thigh, breast, drumstick, wing, liver and abdominal fat percentage of birds had not significantly affected by the various inclusion levels of fish meal in the diet. Salih (2009) noted that imported protein concentrates replacement by the roasted fish meal at various substitute levels had no differences in the carcass and giblet weight of treatment birds at 3.5% level of substitution. Similar findings were reported by Mikulec *et al.* (2004), Ewa *et al.* (2017), Agbede and Aletor (2003), Rosenfeld *et al.* (1997).

On the other hand, our results are not in agreement by the findings of Ponce and Gernat (2002) who reported that replacement of soybean meal protein with fish meal protein at various substitute level had affect the carcass yield of birds from 14 to 28 days of age, and there is no difference were found in last 2 weeks of age. Al-Marzooqi *et al.* (2010) noted that at 10 and 20% levels of replacement of soybean meal with fish silage had improved the heart weight and liver weight of birds. Jassim (2010) found that different inclusion levels of fish meal as a protein source in the diet had increase protein carcass and the percentage of the fat decrease. Similar findings were reported by Salih (2009), Maigualema and Gernat (2003), Hassanabadi *et al.* (2008), Ullah *et al.* (2018).

***Conclusion*:** Results of this experiment revealed that replacement of soybean meal with fish meal up to 45% levels cause no negative effect on growth performance and carcass characteristics of Japanese quail. So it could be concluded that replacement of fish meal can be a viable dietary protein source for quails. Additional research is required to assess the prolonged effects of fish meal supplementation on nutrient digestibility, meat quality and economic feasibility

***Authors contribution*:** MA**:** Execution of experiment, sampling, data analysis and manuscript write-up. JAB: Problem identification and data analysis. RU: Execution of experiment. H: Data analysis and manuscript write-up. R: Review of manuscript and sample analysis.

***Conflict of interest:*** authors declare no conflict of interest

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***Ethical statement:*** All procedures followed in the conduct of this experiment were approved by Advanced Studies and Research Board, University of Agriculture, Faisalabad, Pakistan.

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***Consent to participate:NA***

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***SDGs addressed*:** Zero Hunger, Responsible Consumption and Production, Life on Land.

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